The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 16

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte STURE PETTERSSON, GORAN THUNGSTROM and HARRY WHITLOW

Appeal No. 2000-2109
Application No. 09/159,609

ON BRIEF

Before KRASS, FLEMING, and BLANKENSHIP, ***Administrative Patent Judges.***

FLEMING, ***Administrative Patent Judge***.

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 1, 2, 4 through 6, 8 through 10, 12 through 14 and 16 through 20, all the claims pending in the application. Claims 3, 7, 11 and 15 have been canceled.

The invention relates to an integrated semiconductor detector telescope device. The device includes a ΔE (dE) detector portion (14) and an E detector portion (18). The device also includes a low resistivity metal interlayer (16). See

Appellants' specification page 6, lines 4-16 and Figure 2. Further, the ΔE-E detector telescope is fabricated by wafer bonding a ΔE detector portion (14) in the form of a first semiconductor wafer to an E detector portion (18) in the form of a second semiconductor wafer by silicidizing a thin metal layer (16). See Appellants' specification page 7, lines 21-28 and page 10, lines 19-25. The thin metal layer acts as a common contact between the two detectors and represents a dead-layer which minimizes cross-talk between the ΔE and E detector portions. See Appellants' specification page 5, lines 28-32.

Independent claim 1 present in the application is reproduced as follows:

1. A device forming a low threshold energy, low cross talk and high energy resolution integrated semiconductor detector telescope having a very thin well-supported ΔE detector portion and a low resistivity metal interlayer, wherein a ΔE-E detector telescope is fabricated by wafer bonding a ΔE detector portion in the form of a first semiconductor wafer to an E detector portion in the form of a second semiconductor wafer by silicidizing a thin metal layer, said thin metal layer acting as a common contact between the two detectors, whereby said metallic layer explicit is thin and represents a small dead-layer and a low resistivity, thereby minimizing cross-talk between the ΔE and E detector portions.

References

The references relied on by the Examiner are as follows:

Meuleman	3,511,722	May 12, 1970
Husimi et al. (Husimi)	4,340,899	Jul. 20, 1982

Buti et al. (Buti)	5,382,832	Jan. 17, 1995
Temple et al. (Temple)	5,654,226	Aug. 5, 1997

Kim, Y. et al. "Epitaxial Integrated dE1-dE2 Silicon Detectors." Nuclear Instruments and Methods in Physics Research, Vol. 226 (1984), pp 125-128.

Rejections at Issue

Claims 1, 2, 4 through 6 and 9 stand rejected under 35 U.S.C. § 103 as being unpatentable over Husimi, Temple and Buti.

Claims 1, 2, 4 through 6, 8 and 9 stand rejected under 35 U.S.C. § 103 as being unpatentable over Meuleman, Temple and Buti.

Claims 10, 12 through 14 and 17 through 20 stand rejected under 35 U.S.C. § 103 as being unpatentable over Husimi, Temple, Buti and Kim.

Claims 10, 12 through 14 and 16 through 20 stand rejected under 35 U.S.C. § 103 as being unpatentable over Meuleman, Temple, Buti and Kim.

Rather than repeat the arguments of Appellants or the Examiner, we make reference to the Brief[1] and the Answer for the respective details thereof.

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[1] Appellants filed an Appeal Brief on April 17, 2000.

OPINION

After a careful review of the evidence before us, we do not agree with the Examiner that claims 1, 2, 4 through 6, 8 through 10, 12 through 14 and 16 through 20 are unpatentable under 35 U.S.C. § 103.

First we will address the rejection of claims 1, 2, 4 through 6 and 9 as being unpatentable under 35 U.S.C. § 103 over Husimi, Temple and Buti. We note that claim 1 is the independent claim with claims 2, 4 through 6 and 9, dependent on claim 1.

Appellants argue that "[i]ndependent claim 1 calls for **the first and second semiconductor wafers to be bonded together by 'silicidizing a thin metal layer' therebetween."** (Emphasis added). See page 5, lines 25-27 of the Brief. Appellants further argue that,

> Husimi's device provides a completely distinct structure. In particular, rather than a thin metal layer which bonds together and serves to electrically isolate two distinct semiconductor wafers, Husimi provides **a single semiconductor wafer having an N+ layer buried therein** which isolates the dE detector from the E detector. (Emphasis added). See page 5, lines 29-34 of the Brief.

Appellants then argue that neither the Temple nor the Buti references describes or suggests "bonding a first semiconductor wafer to a second semiconductor wafer by silicidizing a thin metal layer therebetween to provide a ΔE-E semiconductor detector telescope." See page 8, lines 24-28 and page 9, lines 3-6 of the Brief.

For the rejection of claim 1, the Examiner states that,

> Husimi et al. show an E-dE detector with an epi layer for the dE detector (see Figure 2(a)[)] and show that the dE detector layer is less than 10 microns (column 1, line 14). Temple et al. show that to avoid the expense of growing an epi layer it is cost effective to bond a second wafer to the first using silicide (column 1, line 9). Buti et al. show that when two wafers are bonded together, one wafer may be thinned to reach a given thickness (Figure 1F and column 4, line 24). **It would have been obvious to modify the Husimi et al. device to use a second wafer as taught by Temple et al. and to thin the second wafer to the necessary thickness as taught by Buti et al.** (Emphasis added). See page 3, line 14 to page 4, line 2 of the Answer.

In response to Appellants' arguments, the Examiner states that "Applicant states that Husimi et al. do not show siliciding, which is true, but Husimi et al. is not relied upon to teach this." See page 5, lines 12-13 of the Answer. The Examiner continues by stating that, "Husimi et al. addresses the technology of 1980 and the more modern reference of Temple et al. teaches that it is cost effective to use wafer bonding rather than epitaxial growth and Temple et al. addresses the technology of 1994." See page 6, lines 2-4 of the Answer. Finally, the

Examiner states that "Applicant states that Temple et al. do not show the formation of a dE-E detector, which is true but note that Temple et al. are relied upon to show wafer bonding." See page 6, lines 7 and 8 of the Answer.

In rejecting claims under 35 U.S.C. § 103, the Examiner bears the initial burden of establishing a ***prima facie*** case of obviousness. ***In re Oetiker***, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). Further, our reviewing court in ***In re Dembiczak***, 175 F.3d 994, 999-00, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999) has said,

> Broad conclusory statements regarding the teaching of multiple references, standing alone, are not 'evidence.' *E.g.,* ***McElmurry v. Arkansas Power & Light Co.***, 995 F.2d 1576, 1578, 27 USPQ2d 1129, 1131 (Fed. Cir. 1993) ("Mere denials and conclusory statements, however, are not sufficient to establish a genuine issue of material fact."); ***In re Sichert***, 566 F.2d 1154, 1164, 196 USPQ 209, 217 (CCPA 1977).

We note that the Appellants' claim 1 recites the following:

> a ΔE-E detector telescope is fabricated by wafer **bonding** a ΔE detector portion in the form of **a first semiconductor wafer to** an E detector portion in the form of **a second semiconductor wafer by silicidizing a thin metal layer . . . .** (Emphasis added).

In understanding these claim limitations, we find that Appellants' claim calls for two distinct wafers that are bonded via silicidizing a thin metal layer so as to form the ΔE-E detector. We cannot agree that a generic Temple teaching of wafer bonding by silicidizing provides the necessary teaching and suggestion to replace the prior arts teaching of a single wafer, used in the Husimi ΔE-E detector, with first and second semiconductor wafers as claimed.

Upon careful review of Husimi, we find that Husimi discloses "[a]n epitaxial integrated E-dE solid state detector telescope comprising a dE detector produced on an epitaxial layer and an E detector produced on a high purity silicon layer, **both of which are fabricated on a single silicon wafer.**" See the abstract lines 1-4 and column 1, lines 41-44 of Husimi. We further find that, "[a B layer] is a heavily doped N+ type silicon layer which is produced by diffusion of impure Antimony into [an N type silicon substrate]." See Figure 2 and column 2, lines 60-67 of Husimi. We find nothing in the Husimi reference that teaches two semiconductor wafers and hence we find no teaching of bonding two wafers by silicidizing a thin metal layer therebetween. Further, we find Temple discloses that "emitter regions formed in the backside of the device wafer may be electrically connected via a metallic silicide . . .". See column 1, lines 53 and 54 of Temple. We also find that Temple discloses that "[t]he two wafers may then be **selectively bonded in the areas 18**

sufficiently for the carrier wafer 12 to provide the necessary mechanical support. . .". (Emphasis added). See column 2, line 66 to column 3, line 1 of Temple. Furthermore, we find that Temple discloses, "[a]s shown in FIG. 3, it may be desirable to bond the carrier wafer to the device wafer over most, if not all, of the wafers and to eliminate the separation step." See column 3, lines 56-58 of Temple. However, we fail to finding any teaching or suggestion for bonding two wafers in a ΔE-E detector by silicidizing a thin metal layer. This limitation is critical as explained in Appellants' disclosure of the ΔE-E detector wherein,

> a thin buried metallic layer in the semiconductor gives a small series resistance, therefore a small RC constant and fast charge carrier collection. Furthermore, the low resistivity in the buried metallic layer ensure minimal signal cross-talk between the two detectors due to charge carrier funneling. . . . See page 5, lines 28-32 of Appellants' specification.

Lastly, we find nothing in Buti that teaches or suggests bonding two semiconductor wafers by silicidizing a thin metal layer.

In providing motivation or a suggestion to combine, we find that our reviewing court states in ***In re Lee***, 277 F.3d 1338, 1342-43, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002),

> [t]he essential factual evidence on the issue of obviousness is set forth in ***Graham v. John Deere Co.***, 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966) and

> extensive ensuing precedent. The patent examination process centers on prior art and the analysis thereof. When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness. See, e.g., ***McGinley v. Franklin Sports.***, 262 F.3d 1339, 1351-52, 60 USPQ2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the Graham factors).

We find that the Examiner states on page 3, line 19 to page 4, line 2 of the Answer that, "[i]t would have been obvious to modify the Husimi et al. device to use a second wafer as taught by Temple et al. and to thin the second wafer to the necessary thickness as taught by Buti et al."

Having reviewed the Husimi, Temple and Buti references, we find no factual basis or motivation for suggesting their combination as suggested by the Examiner. Further, we find no evidence to modify the Husimi reference, in light of Temple, to replace the single doped wafer with two separate wafers bonded by silicidizing a thin metal layer therebetween.

Therefore, we will not sustain the Examiner's rejection of claim 1 as being unpatentable under 35 U.S.C. § 103 over Husimi, Temple and Buti. Claims 2, 4 through 6 and 9 are dependent on claim 1, and therefore include the aforementioned limitations of claim 1. Therefore, we will not sustain the Examiner's rejection of claims 2, 4 through 6 and 9 as being unpatentable under 35 U.S.C. § 103 over Husimi, Temple, Buti and Kim.

Next, we will address the rejection of claims 1, 2, 4 through 6, 8 and 9 as being unpatentable under 35 U.S.C. § 103 over Meuleman, Temple and Buti. We note that claim 1 is the independent claim with claims 2, 4 through 6, 8 and 9, dependent on claim 1.

Appellants argue that Meuleman neither describes nor suggests a ΔE detector portion in the form of first semiconductor wafer and an E detector portion in the form of a second semiconductor wafer. See page 11, lines 12-16 of the Brief. Rather, "Meuleman describes a detector in the form of a single wafer monolithic assembly." See page 11, lines 16 and 17 of the Brief. Appellants further argue that "the Meuleman device is structured to overcome the need to bond the E and ΔE detector portions together. Like Husimi, Meuleman provides a single semiconductor wafer [and] Meuleman does not describe or suggest in any manner the bonding together of two wafers." See page 11, lines 22-26 of the Brief.

In rejecting claim 1, the Examiner states that "Meuleman show[s] an E-dE detector using an epi layer junction on top of a junction and the above arguments can be repeated with Meuleman replacing Husimi et al." See page 4, lines 16-18 of the Answer. In responding to Appellants' arguments, the Examiner then states that "Applicant states that Meuleman does not show a two wafer structure, which is true, but note that Meuleman is combined with other references to show that the claimed device is obvious." See page 6, lines 13-15 of the Answer.

Upon careful review of Meuleman, we find that Meuleman discloses an E-dE detector wherein the "starting element is chosen [with] a wafer of 500 microns thickness . . .". See column 3, lines 74-75 of Meuleman. Further, a "monolithic assembly has been obtained by first providing the junction J_1' in a semiconductor wafer by known diffusion methods." See column 3, lines 56-59 of Meuleman. Lastly, we find that "[t]he diffused zone B thus provided is strongly doped . . .". See column 4, lines 21-22 of Meuleman. However, as with Husimi, we find nothing in the Meuleman reference that teaches two semiconductor wafers and hence we find no teaching of bonding two wafers by silicidizing a thin metal layer therebetween. Therefore, we will not sustain the Examiner's rejection of claim 1 as being unpatentable under 35 U.S.C. § 103 over Meuleman, Temple and Buti. Claims 2, 4 through 6, 8 and 9 are dependent on claim 1, and therefore include the aforementioned limitations of claim 1. Therefore, we will not sustain the Examiner's rejection of claims 2, 4 through 6, 8 and 9 as being unpatentable under 35 U.S.C. § 103 over Meuleman, Temple, Buti and Kim.

We note that in rejecting claims 10, 12 through 14 and 17 through 20 under 35 U.S.C. § 103, which are dependent on independent claim 1, the Examiner further applied the Kim reference to the combination of the Husimi, Temple and Buti. We further note that in rejecting claims 10, 12 through 14 and 16 through 20 under 35 U.S.C. § 103, which are dependent on independent claim 1, the Examiner further applied the Kim reference to the combination of the Meuleman, Temple and Buti. However, we find nothing in the Kim reference that provides any suggestion for overcoming the Husimi, Temple and Buti references deficiency, or the Meuleman, Temple and Buti references deficiency, of failing to teach the claimed two semiconductor wafer bonding by silicidizing a thin metal layer. Therefore, we will not sustain the Examiner's rejection of claims 10, 12 through 14 and 16 through 20.

In view of the foregoing, the decision of the examiner rejecting claims 1, 2, 4 through 6, 8 through 10, 12 through 14 and 16 through 20 under 35 U.S.C. § 103 is reversed.

REVERSED

ERROL A. KRASS Administrative Patent Judge	)	
MICHAEL R. FLEMING Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
HOWARD B. BLANKENSHIP Administrative Patent Judge	)	

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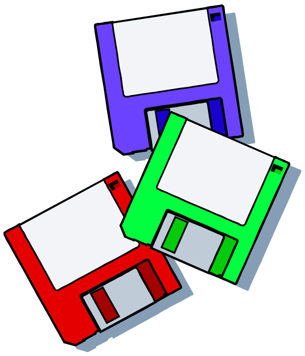

Lesley

Appeal No. 2000-2109
Application No. 09/159,609

APJ FLEMING

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DECISION: <u>REVERSED</u>

Prepared: August 6, 2003

Draft Final

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